Sempervirens
Spring 2024 The Quarterly of the Virginia Native Plant Society

2024 WOY: *Turtleheads and Bumblebees*

Article, photos, and illustration by W. John Hayden, Botany Chair

Francis Whittier Pennell (1886-1952) was a prominent American botanist who specialized in a group of plants then known as Scrophulariaceae, i.e., the Snapdragon Family. Among his many accomplishments, Pennell (1935) published a 650-page treatise, "The Scrophulariaceae of eastern temperate North America," and he was engaged in a similar effort for western North America at the time of his death. It is safe to assert that, for the first half of the 20th century, Pennell was THE authority on the Snapdragon Family. In Pennell's day, indeed, throughout the following half century, the VNPS Wildflower of the Year for 2024, *Chelone glabra*, White Turtlehead, was classified in Scrophulariaceae. In Pennell's *magnum opus*, we find one of the earliest statements about pollination of Turtlehead flowers, an assertion that the flower structure of *Chelone* "is admirably fitted in size and form for pollination by bumblebees." This article relates what we now know about pollination and the *Chelone-Bombus* pollination symbiosis.

Insert inside!
2024 VNPS WOY brochure
White Turtlehead
Chelone glabra

Before delving into the pollination story, however, we must first acknowledge that times change and science marches on. Pennell's concept of Scrophulariaceae has, to a large extent, disintegrated in the face of overwhelming evidence from modern DNA-based studies designed to test relationships among the Snapdragons and their relatives. Consequently, *Chelone* and many other plants that Pennell considered as "scrophs," are now classified in family Plantaginaceae.

Figure 1. *Chelone glabra*, recently opened male-phase flowers, with unidentified bumblebee entering the corolla tube.

Thomas S. Cooperrider (1927-2021), botanist at Kent State University, was the first to test Pennell's assertion about Turtleheads and bumblebees with a published (Cooperrider 1967) series of observations from northeastern Ohio. Not surprisingly, Cooperrider was able to confirm that bumblebees were the most frequent floral visitors to *Chelone glabra* (Figure 1) and, critically, that bumblebees were effective in accomplishing the quintessential act of pollination, i.e., the deposition of pollen on stigmas. The following paragraphs recount some of the observations documented by Cooperrider.

White Turtlehead flowers have tubular corollas that are two-lipped distally. The lower lip is hairy and functions as a landing pad for floral visitors. Pollen-bearing anthers and stigma are located on the upper side of the tube (Figure 2). Thus, upon entering the floral tube, the dorsal (back) side of a bumblebee's hairy thorax brushes against the anthers and stigmas. In short, the spatial configuration of bee and flower ensure pollen transfer from anther to bee and from bee to stigma. Rarely, bumblebees alight on the top of the floral tube and, somewhat acrobatically, enter the floral tube upside down; presumably these inverted floral visits would be less effective in accomplishing pollination than the usual right-side-up visits. Further, Cooperrider confirmed that a common aspect of bee-mediated pollination holds true for *Chelone glabra*: upon visiting a spike of Turtlehead flowers, bumblebees first approach the lowest open flower

(See White Turtlehead, page 2)

White Turtlehead

(Continued from page 1)

and then work the remaining open flowers in succession, from bottom to top.

Cooperrider supported his direct observations with several straightforward manipulations of individual flowers using plants grown in the open and other plants grown in cages to exclude insect visitors. These experiments were designed to reveal deeper details about this pollination symbiosis. Three main points emerged:

1) When intact plants were kept in cages to exclude pollinators, no seed was set, revealing the essential role of insect visitors for Turtlehead reproduction and showing that self-pollination appears not to occur.

2) When corollas of un-caged plants were carefully removed, leaving stamens, pistils, and nectaries intact, no seeds formed; but, when similarly altered flowers on caged plants were hand-pollinated, seed set was abundant. This manipulation reveals the essential role played by the corolla to initiate the process—no floral visit, no pollination!

3) It made no difference whether trimmed flowers of caged plants were hand pollinated with pollen from the same plant, or with pollen collected from a plant found at some distance from the caged individual, seed set was abundant in both cases; indicating that both self-pollination and cross-pollination can be effective in *Chelone glabra*. Points 1 and 3, taken together, indicate that, while self-pollination within a single flower appears not to occur spontaneously, self-sourced pollen would be functional if it reached a stigma as a result of pollinator activity, an event that certainly could happen as bumblebees visit successive flowers in a single spike or visit multiple spikes of the same plant.

Just as the science of systematics has advanced since Pennell's day, so has the science of pollination biology. Roughly a half-century after Cooperrider's publication, two botanists from New England decided that there was more to know about Turtlehead pollination. Thus, Leif L. Richardson and Rebecca E. Irwin (2015) undertook a three-year study of *Chelone glabra* involving seven sites in New Hampshire. Richardson and Irwin did not dispute Cooperrider's results, but they did, reasonably, characterize his report as largely qualitative in nature; in contrast, Richardson and Irwin endeavored to provide quantitative insights as they plumbed additional details about the process. Frankly, quantitative details, as important as they can be, tend to get in the way of telling a good story, so anyone interested in the numbers is encouraged to read Richardson and Irwin's paper in the original.

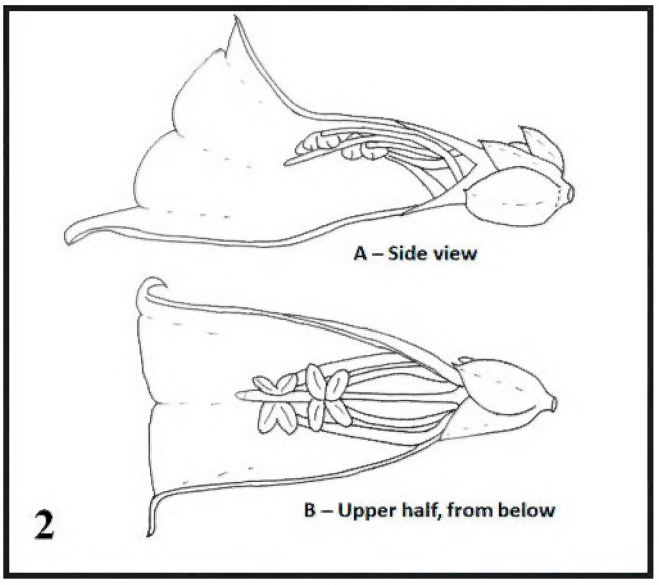

Figure 2. Didynamous stamens of Plantaginaceae; A – side view with corolla partially removed; B – upper side of corolla, viewed from below. These diagrams are based on dissected Foxglove (*Digitalis purpurea*) flowers; didynamous stamens of *Chelone* are similar, but its dense hairs obscure the details shown here.

Richardson and Irwin (2015) point out that flowers of *Chelone glabra* are protandrous, meaning that newly opened flowers shed pollen for about one day before stigmas become receptive to pollen. During the initial staminate or "male phase," styles are short, and the non-receptive stigmas are pressed against the "ceiling" of the corolla tube (Figure 2). During the subsequent pistillate or "female phase," the styles have elongated and curved slightly downward, placing the receptive stigmas distal to the anthers (Figure 3), in a position where they would contact pollen-laden backs of bumblebees as they first enter the flower. Because flower opening in the spike inflorescence of *Chelone* occurs from the bottom up, when multiple flowers are open, those towards the top will be in male phase and those near the bottom, and old enough, will be in female phase. Thus, when a bumblebee approaches a new Turtlehead flower spike, having already visited flowers of another plant, the bee will likely deposit some of that previously acquired pollen on the first few flowers of the new plant before picking up new pollen from the upper flowers. Bee behavior, protandry, and inflorescence structure thus work together to promote the possibility of cross-pollination.

Whereas Cooperrider refers merely to bumblebee pollinators, Richardson and Irwin (2015) identified 18 different species of visitors to flowers of *Chelone glabra*. By far, however, most floral visits,

about 72%, were accomplished by the Half-black Bumblebee, *Bombus vagrans*; other visitors, in descending order of frequency, included sweat bees of the genus *Lassioglosum*, the Ringed Yellow-face Bee (*Hylaeus annulatus*), several unidentified kinds of flies, the Common Eastern Bumblebee (*Bombus impatiens*), and, at frequencies less than 2 percent each of the total, 14 additional species or unidentified groups of insects. Significantly, Richardson and Irwin judged the Ringed Yellow-face Bee and other solitary bees to be sufficiently small that they could slip past stigma and anthers without contacting either and are, therefore, not likely to have brought about a successful transfer of pollen between Turtlehead flowers. The obvious conclusion is that the Half-black Bumblebee is the most effective pollinator of Turtleheads in the populations studied. Richardson and Irwin also generated an estimate of number of pollen grains per newly opened flower to be approximately 130,000, and they measured number of pollen grains left after a single floral visit by the various insects included in their study—these results further support the prime significance of Half-black Bumblebees in the Turtlehead populations they studied.

There is more, much more, in Richardson and Irwin's (2015) paper; the whole paper is well worth a close read by anyone interested in how pollination biology is studied nowadays.

Lest one think that studies of pollination biology always end in a heart-warming affirmation of the exquisitely fine-tuned nature of plant and pollinator co-adaptations, two additional results from the Richardson and Irwin (2015) study should be considered. In one set of experiments, seed set in open-pollinated flowers was compared to seed set in open-pollinated flowers that also received extra pollen deposited on stigmas by the hands of the scientists; plants that received supplemental pollen set one fifth more seed than flowers serviced solely by natural pollinators. The conclusion is that fertility in *Chelone glabra* is pollen-limited, i.e., seed reproduction could be better if pollinators did a little better job delivering more pollen to stigmas. Further, in one of their study years, more than 75% of all fruits were destroyed by seed predators and other herbivores; these predators included Baltimore Checkerspot (*Euphydryas phacton*) caterpillars, White-tailed Deer (*Oedocoileus virginianus*), and White-footed Mice (*Peromyscus leucopus*). Sometimes it just does not matter how efficient and fine-tuned the pollinator-plant symbiosis might be—other biological or environmental factors can impose drastic negative impacts on reproductive success. Indeed, life can be harsh. Nevertheless, occasional reproductive success, even at theoretically sub-optimal rates, can be enough to ensure survival in the long run.

Figure 3. *Chelone glabra*, several day-old flower, late in the pistillate or "female" phase; note style and stigma projecting down from the top side of the corolla tube.

Do the publications summarized here (Cooperrider 1967, Richardson and Irwin 2015) tell us everything there is to know about pollination biology of *Chelone glabra*? Those two papers do tell us a lot, but personally, I am sure there is more to learn. What we have are just two studies, one located in northeastern Ohio, the other in northern Vermont; the native range of White Turtlehead, however, is quite large, extending from southern Canada nearly to the Gulf of Mexico and from the Atlantic Coast to the Mississippi River. Might pollination biology in southern or extreme western portions of its range be different? The Half-black Bumblebee is known to occur throughout the range of White Turtlehead, but one study in New Hampshire does not constitute proof that Half-black Bumblebees would be White Turtlehead's major pollinator throughout the plant's extensive range. Might there be other mid-size bumblebee species that are effective pollinators of this plant in other parts of the range? We don't even know the identity of the bumblebees that Cooperrider observed in Ohio. Has anyone used genetic tools to evaluate the balance between self- and cross-pollination that occurs under natural conditions

(See Pollination, page 4)

Campaign to support Virginia's NAPs finishes with a bang

Last fall we asked our members and friends to consider supporting the Virginia Natural Area Preserves through a fundraising campaign. Many responded with generous gifts and helped us exceed our $50,000 goal. Toward the end of the campaign, a large anonymous gift of $25,000 elevated the total and we were able to contribute $85,112 to the Virginia Natural Heritage Fund. What a wonderful way to wrap up the campaign!

Virginia Bluebells (*Mertensia virginica*) at Calmes Neck Bluffs, Clarke County, a VNPS Registry Site. (Gary P. Fleming photo)

We are deeply grateful to all who stood firm with us in supporting conservation of precious natural habitats for future generations of wildlife and humans. Thank you to our generous donors – every single donation matters because it demonstrates our commitment to what we value highly as a community – native plants and wild spaces. Thank you also to all chapters who committed resources from their budgets to support the fundraiser. We know they have plenty of competing local priorities to fund, and we appreciate their trust in our Society's ability to put dollars where it matters the most. Finally, huge gratitude is owed to all members of the Board who helped organize and lead the campaign to a successful closure.

Almost daily we read or hear about the devastating loss of biodiversity–locally and globally. We are touched by our members doing their part–supporting conservation financially and in many other ways, whether it's invasive plant removal, educating the public (especially younger generations), instilling respectful stewardship of land and wildlife, and championing nature every way they can.

As our largest contributor to the fundraiser told us, "Making this gift could not be passed up. The need for saving our state's natural heritage is so critical to the protection of biodiversity." He also shared his belief that a "dedicated Commonwealth funding program" is sorely needed. "Virginia's lands encompass outstanding biodiversity, more so than that of many other states. In this time of habitat loss across the world, and here at home, we all need to do what we can to protect our planet's and our state's natural heritage. But we also need to put pressure on our legislators for direct, ongoing, and sufficient state funding for this effort so that future generations will still share a fully functioning environment. Only the Commonwealth has the ability to do this justice." VNPS leaders and members wholeheartedly agree with this call for action. We also agree with his favorite quote, "Saving biodiversity saves us."

Science is telling us that preventing and possibly reversing biodiversity loss is no longer an "environmental issue." Yes, we should be concerned that one million species are threatened with extinction, that wildlife is squeezed out of natural habitats, that pollinators are dying off. But it is not just our moral responsibility. Biodiversity loss has become a threat to the stability of life on the planet and we thank our members and friends for doing all they can to help conserve Virginia's natural habitats.

–Emilia Godwin, Fundraising Chair

Pollination

(Continued from page 3)

in Turtlehead populations? We have one recorded observation from one year on the impact of herbivores and seed predators and reproductive success of White Turtlehead; more data, for longer spans of time, and at multiple locations across its extensive native range surely would prove interesting. Finally, there may well be aspects of the pollination biology of Turtleheads that, at this point in time, remain unknown to us—it is difficult, indeed, to articulate that which we do not know.❖

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Legislative lobbying efforts have been intense

From the President
Nancy Vehrs

Mark your calendar to save the weekend of September 20-22 for the VNPS Annual Meeting! We've chosen Massanetta Springs Camp and Conference Center in Harrisonburg as our location. Massanetta Springs offers the complete package for us: standard hotel rooms, some camping opportunities, meals, a large meeting room, and easy access to many field trip sites. We thank Lora Steiner of the Shenandoah Chapter for her efforts in finding this venue for us. The September date is early enough that there should be many plants still in bloom in the mountains. The VNPS Executive Committee is serving as the primary planning committee for the annual meeting, and first vice president Kevin Howe is coordinating the field trips. We welcome other members who would like to serve on the committee; contact me at president@vnps.org.

This year has been a busy one for our Virginia General Assembly. In even-numbered years, the GA holds a "long session" of 60 days, and in odd-numbered years the session is only 30 days. Legislators filed many bills of interest to the VNPS this session, especially on the subject of invasive plants. The process is still fluid as I write this at the end of February, but we are hopeful on many fronts. Bills to require retailers to label invasive plants at the point of sale (HB47 and SB306) have undergone many amendments during committee consideration but emerged stronger. While we would prefer a ban on the sale of invasives, educating customers about their choices is an important step. We thank Delegate Holly Seibold and State Senator Saddam Azlan Salim for filing these bills and standing strong on them.

Another bill that is still in play is HB1167 patroned by Delegate Paul Krizek that would allow localities to ban the sale of English Ivy. This is narrowly focused but brings attention to the damage caused by English Ivy and might allow consumers to explore substitute plants if they are not presented with the option of buying this invasive plant. HB320, patroned by Delegate David Bulova, would allow unpaid volunteers to apply herbicides to invasive plants on public lands under the supervision of a certified pesticide applicator and only with the permission of the public land managers. This bill was strongly supported by our partner, the Blue Ridge Partnership for Regional Invasive Species Management (PRISM).

Funding for conservation agencies and invasive plant control was also an issue this year, and legislators submitted several budget amendments on this front. The House budget included funding for those amendments, but the Senate budget did not. To conform the two budgets, legislators from both houses are appointed to a conference committee to hash out the details. Let's hope that conservation funding prevails! We have several members who have walked the halls of the General Assembly building meeting with legislators, testifying at committee meetings, and making the case for legislation. Chief among them is our volunteer lobbyist Tom Smith who has performed yeoman's work in presenting our positions. Jim Hurley, our invasive plants educator has also been a regular in Richmond. Conservation Chair Barbara Ryan has stayed on the home front, keeping track of legislation and participating in weekly Zoom meetings held by the Virginia Conservation Network, an umbrella organization partner that tracks all of the conservation bills. Thank you, team!

Of course, there were some setbacks as well. One was the "defeat" of HB528 that was patroned by Delegate Krizek. This bill would have made an exemption for managed conservation landscaping in homeowner association-controlled developments and was patterned after similar legislation in Maryland that was successful. HB528 will be discussed during the off season and will return next year so it is not dead. Though not technically about native plants, unfortunately, this session also saw legislation to designate the European Honeybee as the State Pollinator with unanimous support.

Spring is finally upon us and early bloomers such as Hepatica, Spring Beauty, and Bloodroot are starting to flower. Festivals in celebration of our beloved Virginia Bluebells are being held in a number of locations in Northern Virginia in early to mid-April. Please take some time from your busy schedules to get out and enjoy spring with a walk in a natural area. You will benefit both physically and mentally.❖

Plant voices made a difference on Chesterfield solar project

Some of you may recall that the VNPS issued an action alert in May of last year regarding a proposed solar facility in Chesterfield County, State Corporation Commission Case Number PUR-2022-00179. The site has a number of rare plant species, including the following:

Cuthbert's Turtlehead - S2G3
Red Milkweed - S2G4G5
Large Spreading Pogonia Orchid - S1G4
Sheep Laurel - S2G5
Squarehead - S1G5
Purple Pitcher Plant - S2G5
Velvet Sedge - S2G5
Small White Fringed Orchid - S2G5

The State Corporation Commission issued its final order on September 18, 2023. It adopted the Hearing Examiner's findings and recommendations along with a requirement that the applicant file a bimonthly status update with the commission. While the project was approved, there were significant environmental commitments. The final order noted, "The Commission recognizes the large volume of public comments that overwhelmingly expressed concern for the rare plants historically found in the Project area and support for the protection of these rare plant species." The order further stated, "Lastly, the Commission emphasizes that the Company has made commitments regarding protection of these rare plants, including to consult with DCR and to incorporate DCR's comments into the Company's final vegetation management plan to the extent reasonably practicable. Further, the Company has committed to 'adjusting the Project footprint to avoid rare plant species if such can be accomplished without seriously affecting the size and the economics of the Project.' The Commission expects the Company to abide by these important commitments."

Among the plants that will now receive some degree of protection are, clockwise from top left: Small White Fringed Orchid, Large Spreading Pogonia, Cuthbert's Turtlehead, and Purple Pitcher Plant.

While not a true win, your voices were heard and made a difference. The Final Order, other applicable documents, and the follow-up reports can be found online at https://scc.virginia.gov/DocketSearch#caseDocs/143629.

Since that time, the VNPS adopted a statement on Utility-Scale Solar.

–Nancy Vehrs, President

Mile-a-Minute takes a hit on Hankey Mountain

Sempervirens readers might remember an article last summer about efforts made by local volunteers in partnership with the U.S. Forest Service to eradicate a newly-discovered patch of the non-native, highly invasive Mile-a-Minute (MM) vine in northwestern Augusta County in the Shenandoah Mountain area of the George Washington National Forest.

Together 35 volunteers, in partnership with the Forest Service, made a concerted effort to wipe out Mile-a-Minute from Hankey Mountain. After the Forest Service sprayed the patch with a pre-emergent herbicide in May of 2023, hikers and naturalists gathered on June 3 to pull tens of thousands of MM vines on a several-acre patch. This was the first time that many of the group had tackled MM, and some of us wondered at the effectiveness of the work.

In October, several folks went out to the site and walked along the forest road in order to assess the situation. As Lynn Cameron, with the Friends of Shenandoah Mountain, explained: "We could not find a single MM along the road. Our hopes rose. Then we hiked through the upper section above the road looking for the vines and blue berry-like seeds. Last year at this time, the patch was loaded with vines and seeds. We did not find a single MM on the section above the road. This seemed too good to be true.

"Then we made our way into the steep area below the road. This is where the vines had covered the trees with dense growth last year. We didn't find a single MM within 100 feet of the road. We moved on down the mountain to the lower half of the downhill patch. Finally, we found a few MMs among native vines. Three of us scoured the patch for a couple of hours. We found a few more isolated plants which we pulled. Some had seed that was only partially developed and still green. We managed to

(See Mile-a-Minute, page 12)

Statement on utility-scale solar adopted by VNPS Board

(Adopted January 16, 2024 https://vnps.org/statement-on-utility-scale-solar/)

Background

Utility-scale solar facilities in the right place are a necessary and important variable for Virginia to achieve a future with clean energy.

In 2020, the General Assembly passed the Virginia Clean Economy Act (VCEA), setting a goal to make Virginia's energy economy carbon-free by 2050 and establish a 16,100 MW goal for energy generation from solar and onshore wind.[1] As of August 2023, the Virginia Department of Environmental Quality (DEQ) had solar permits and applications expected to cover 86,650 acres supplying 7,542.2 MW.[2]

We must encourage the siting of solar facilities on already impacted sites such as mined lands, brownfields (properties where potential hazards complicate redevelopment), and residential and commercial facilities.

All sites must employ best management practices including natural community and rare species protections, use of native vegetation, reduction in soil compaction and grading, state-of-the-art stormwater calculations, and erosion and stormwater runoff controls.

Local governments have the greatest authority to regulate new solar facilities. Unfortunately, many facilities are being located in rural localities least equipped to properly plan for them due to overworked small staffs and citizens that can least afford the environmental degradation.

Solar facilities have an approximately 30 year life span. Many developers include the value of reclaimed materials as part of their clean-up bond, when in reality they may have no value at all. As of July 2022, the University of Virginia Weldon Cooper Center for Public Service found just over 25% of the state's 133 counties and cities have decommissioning requirements in a zoning ordinance.[3]

Risks

•Loss of valuable natural communities, rare species and natural areas, prime forest and farmland. Meeting the goal of 16,100 MW will require some 161,000 acres of land at the general rule of 10 acres needed for every 1 MW of solar electricity, or 185,000 acres extrapolating from the current DEQ data set.

This 1.3 MW solar array, built on a Massachusetts landfill, has pollinator plants growing between panel rows. (Lucas Faria, U.S. Department of Energy, photo)

•Negative water quality impacts – need for greater erosion and sediment control and stormwater management requirements, compliance assistance and enforcement.

•Insufficient funds allocated to assure proper cleanup after damage or project end-of-life.

•Environmental justice violations due to sitings in rural underserved locations.

What You Can Do

•Advocate for local governments to require natural community/rare species review and surveys through contact and engagement with the Department of Conservation and Recreation Natural Heritage Program: https://www.dcr.virginia.gov/natural-heritage/ereview.

•Advocate for local governments to require enrollment in the DEQ Virginia Pollinator Smart Program: https://www.dcr.virginia.gov/natural-heritage/pollinator-smart.

•Advocate for solar facility development on mined lands, brownfields, and existing residential and commercial facilities.

•Minimize impacts to prime forest and farm lands. The Nature Conservancy, Solar Siting in Virginia: https://conservationgateway.org/ConservationByGeography/NorthAmerica/UnitedStates/virginia/Pages/solar-siting-va.aspx.

•Advocate for projects to use state-of-the-art best management practices for erosion and sediment control, stormwater runoff, and minimize grading and soil compaction.[4]

•Advocate for your locality to adopt continually improving solar development requirements: "In Virginia, the permitting and siting of solar energy and energy storage facilities is heavily informed by local governments. Therefore, to realize the full potential of solar energy development in Virginia, it is important to understand and support the solar experience, concerns and priorities of local governments."[5] ❖

Resources

[1]Virginia Legislative Information System HB1526, Electric utility regulation; environmental goals. https://lis.virginia.gov/cgi-bin/legp604.exe?201+sum+HB1526.

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South Africa's Fynbos provides wonder, surprise

Okay, yes, opportunities to observe and photograph lions, elephants, giraffes, and zebras were among the top reasons that my friend and I traveled to South Africa last October. But, without a doubt, the icing on the cake was the Fynbos – the Cape Floral Kingdom.

While crisscrossing the country of South Africa, we visited a number of gardens and natural areas, but the best of the best was Kirstenbosh, the National Botanical Garden at Cape Town, where experts have been focusing on "growing, conserving, and displaying South Africa's extraordinarily rich and diverse indigenous plant life since 1913."

What is the Fynbos? The Afrikaans word actually means "fine-leaved plants" and it refers to that swath of land on the very southern tip of Africa. The Cape Floral Kingdom there is the smallest of the six floral kingdoms in the world but the diversity packed into an area about the size of Portugal is incredible. Seventy percent of the plants found here are unique to the region.

Tall protea shrubs (sugar bushes) filled with yellowish-orange flowerheads, covered the heathlands along the coast on the southern tip of Africa near the Cape of Good Hope. (Nancy Sorrells photos)

Much of this habitat would be considered a heathland, but Cape heathland has much more diversity than other heathlands such as the Moors of the British Isles. In the Cape Floral Kingdom, for instance, there are 652 different types of heather. Great Britain has three.

Why the great diversity? Like most places, it's all about location, location, location. As with other heath areas, the soil is notoriously bad, meaning what evolved to grow and thrive in the Fynbos has to have unique characteristics. Almost everything in the Cape Floral Kingdom is also fire dependent, meaning that it needs a periodic fire sweeping through for seeds to germinate and plants to thrive.

The final thing that has made the Fynbos unique is that the repeated glacier advances from reoccurring ice ages never made it to the tip

King of the Fynbos, and South Africa's National Flower
Protea cynaroides
Flowers full of sugar
Pollinated by birds
Only in the Cape
Easy to grow

Proteas of all kinds are the touchstone plants in the Fynbos, the Cape Floral Kingdom of South Africa. The protea that stands above all the others, however, is the King Protea (*Protea cynaroides*). This large, showy protea is the South African National Flower.

Two South African Cycads: The one at left, Lebombo Cycad (*Encephalartos senticosus*), can be seen at the Walter Sisulu National Botanical Garden near Johannesburg, while the one at right, Wood's Cycad (*Encephalartos woodii*), lives at Kirstenbosch National Botanical Garden in Cape Town. The latter is so rare that it has a protective cage around it as well as being micro-chipped and surrounded by motion sensors.

of Africa. As a consequence, the ecosystem here has had two million uninterrupted years to evolve until it now represents one of the most unique habitats in the world.

I want to highlight two of the "top characters" from the Fynbos. By far, the most symbolic plants of this botanical region are the proteas, 136 species, most found only in tropical Africa and 82 found only in the Cape Town area on the tip of the continent. These colorful bulbous flowers atop bushes or shrubby plants are striking. As we traveled the road through the heathlands to the Cape of Good Hope, the mounds of green bushes with orange balls of blooming proteas looked for all the world like a sweep of orange groves in Florida!

Protea flowers are actually flower heads. Many flowers crowd together into a bowl that is surrounded by modified leaves known as floral bracts. Proteas are also called sugar bushes because they have so much sweet nectar. People once used the nectar for cough syrup and food sweetener. Many proteas are pollinated by birds or bats.

Of the many and varied proteas, the one that stands out is the King Protea (*Protea cynaroides*), the national flower that is endemic to the Cape. Botanists in the 1700s gave the specific epithet *cynaroides* because the flower looks like a Globe Artichoke, but the two are unrelated.

The other star of the Fynbos, much rarer than the proteas, are the cycads. Although at first glance these ancient gymnosperms, which bear cones not flowers, look like palm trees, they are not! Cycads are the most primitive seed-bearing plants on earth. They flourished 200-145 million years ago, providing the dinosaurs with their meals. As a group, cycads may date as far back as 300 million years.

Cycads grow around the world in tropical, subtropical, and warm regions of North, Central, and South America, Asia, Australia, and Africa. There are 343 global species globally and 60% of them are threatened with extinction.

In South Africa, most of its 38 cycad species are threatened and three are extinct in the wild. While overharvesting for medicine and habitat destruction are important threats to the survival of cycads, the largest threat far and away to cycad populations is theft. Wealthy individuals want to have a unique cycad in their private gardens in the same way that they might yearn for a portrait by a famous artist. However, removing the plants from the wild means that there is not enough of a healthy population for the plants to survive.

In the middle of Kirstenbosh stands a single tall cycad, known as Wood's Cycad. It was brought to the gardens in 1916. There are no longer any Wood's Cycads in the wild. They were harvested to extinction in the early 20th century. This plant is a sucker collected from two growing in a botanical garden in Durban. Although extinct in the wild, there are probably 500 Wood's Cycad specimens growing around the world. Unfortunately, they are all clones, which means they are genetically identical. And, they are all males. Wood's Cycad will never again be able to form a natural population in the wild.

The desire by plant poachers for specimens such as this lone Wood's Cycad is so great that plant thieves have been known to land helicopters inside gardens at night and steal even plants as large as this cycad. As a consequence this lone survivor has been micro-chipped and caged for its own protection and is surrounded by motion sensors.

Caged plants and blooming sugarbushes are just two of the surprises that we delighted in as we explored the wonders of South Africa's Fynbos.

--Nancy Sorrells, Sempervirens *editor*

Utility ROW in coastal plain yields exciting finds

From Your Natural Heritage Program
By Jenny Stanley
Botanist

As a Virginia Natural Heritage field botanist, I get to work on a lot of different projects. This past year I spent a few weeks exploring the southeastern Coastal Plain, surveying for *Ludwigia ravenii* (Raven's Seedbox), which has been petitioned for federal listing under the Endangered Species Act. As far as plants go, this one doesn't exactly catch your eye. It flowers copiously, but the flowers are green, and without petals, so they blend in with the leaves. The plant is fuzzy all over and likes to sun itself in muddy ditches. Unfortunately, *L. ravenii* is struggling, due to a century of fire suppression and the extirpation of large mammals from the eastern U.S., whose wallows and travel routes may have once provided suitable habitat for the plant. These days, it grows almost exclusively in frequently mowed, roadside ditches. Every once in a while, you'll find it growing in a muddy swale in a utility right-of-way (ROW). I've even found it in a fire road treated with herbicide.

In October, I visited a transmission ROW with Dominion biologist Matt Overton, looking for *Ludwigia ravenii.* Botanically, the ROW wasn't very exciting, but I noticed a smaller nearby distribution ROW on the way back to the truck and we decided to check it out. I felt a moment of dismay as a sea of robust, iris-looking plants with cream-colored flowers greeted us, assuming it must be some new exotic invasive species. But as I got closer, my eyes widened. To my delight it turned out to be *Lachnanthes caroliniana* (Redroot), which hadn't been seen in Virginia since the 1960s. And there were thousands of plants! I was elated and immediately texted photos to three of my botanically inclined colleagues, who were all just as thrilled as I was. They advised me to collect everything associated with it because a cool place like that was bound to have lots of cool plants. Don't worry, I didn't collect everything. Just the things I wasn't sure about. When I got home, tired from a long day of botanizing, I put my bag of plants in the fridge and went to bed.

The next morning, I settled in at the dissecting scope for some quality time identifying the specimens I'd collected. One of the plants was a shrubby little St. John's-wort. It reminded me of *Hypericum densiflorum* (Bushy St. John's-wort), but according to the *Flora of Virginia,* the leaves were too narrow and therefore it didn't key well. So, I reached out to my colleagues, who suggested a couple of possible species, including a southern species not known from Virginia: *Hypericum galioides* (Bedstraw St. John's-wort). Using additional references, the plant keyed straight to *H. galioides*, a southeastern Coastal Plain endemic. As we often do when confirming the identity of unfamiliar species, I emailed a colleague in North Carolina for his opinion. After reviewing my photos, he concluded that it was just a narrow-leaved form of *H. densiflorum*, but I insisted

(See Discoveries, page 11)

Redroot (*Lachnanthes caroliniana*): From left to right, inflorescence, red root, thousands of plants. (Jenny Stanley photos)

Zoom Workshop to focus on plant diversity

Virginia's plant diversity will be the focus on the last two Thursdays of March for the VNPS Annual Workshop. **On March 21 and 28 guests can tune in from 6:30-9 p.m.** Each night will feature a Zoom meet and greet starting at 6:30. At 6:50 welcome and introductions occur before the first of two hour-long sessions begins at 7 p.m. Two experts will be presenting each night.

Visit vnps.org to register. One registration covers both nights.

March 21, 7 p.m. Laura Young, "Protecting Native Species in a Rural Biodiversity Hotspot"

Laura is the Southwest Region Steward with the Virginia DCR Natural Heritage Program. She will cover challenges and strategies for protecting species and communities in rural Southwest Virginia.

March 21, 8 p.m. Nelson DeBarros, "Protecting Native Plants and Natural Communities in Northern Virginia"

Nelson, ecologist for Fairfax County, will review how various organizations are working to protect native plants and natural areas in one of Virginia's fastest growing areas.

March 28, 7 p.m. Shannon Alexander, "Coastal Virginia: Diverse and Dynamic"

Shannon, Coastal Region Steward, Virginia DCR Natural Heritage, will give an overview of the ways in which natural communities are being protected on the Eastern Shore and in the Hampton Roads areas.

March 28, 8 p.m. Kim Biasiolli, "Protecting & Connecting Piedmont Plant Communities"T

Kim, Land Conservationist with the Piedmont Environmental Council, has over 20 years of experience working on biodiversity protection, natural resources management, and land conservation.

Stay tuned because during the workshop Zoom session, the winning design of the official 2024 VNPS T-shirt will be announced as well.

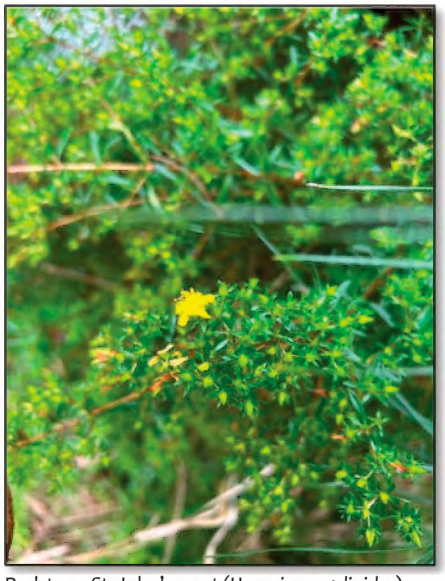
Register now for the Zoom link to the Annual Workshop at vnps.org. ❖

Discoveries

(Continued from page 10)

on mailing him my specimen. After looking at it, he decided that it was *H. galioides* after all - a new species for Virginia and the northernmost occurrence by 100 miles. What a perfect way to wrap up the field season!

Despite centuries of botanical exploration in Virginia, discoveries like these continue to be made at a slow but steady pace. New species mean new conservation opportunities for Natural Heritage, new treatments for the Digital Atlas of the Virginia Flora and the *Flora of Virginia*, and most of all, excitement for botanists.❖



Bedstraw St. John's-wort (*Hypericum galioides*)

Raven's Seedbox (*Ludwigia ravenii*)

Sempervirens (ISSN 1085-9632) is the quarterly newsletter of the Virginia Native Plant Society, Blandy Experimental Farm, 400 Blandy Farm Lane, Unit 2, Boyce, Va. 22620, 540-837-1600, info@vnps.org. Nancy Vehrs, President; Nancy Sorrells, Editor; Karen York, Office Manager. Original material in *Sempervirens* may be reprinted if credit is given to the Virginia Native Plant Society, to *Sempervirens*, and to the author of the material, if named. Readers are invited to send letters, news items, and queries for consideration. E-mail items to Nancy Sorrells at lotswife@comcast.net.

Next submission deadline:
June 1, 2024

Mile-a-Minute stopped

(Continued from page 6)

find two mature blue seeds that we bagged and carried out."

The goal was to eliminate MM on Hankey Mountain and keep it from spreading along the Wild Oak Trail and throughout the trail network into special natural areas on Shenandoah Mountain where it would destroy natural communities and biodiversity. That goal seems to have been achieved. There is no doubt that the work by the Forest Service with the herbicide and the volunteers who followed and pulled the plants by hand, worked.

When the volunteer MM eradication team returned to Hankey Mountain in October to judge the success of their efforts, they could find only two mature MM seeds despite hours of searching. The tiny blue seeds were promptly bagged and removed from the site.

After work by the Forest Service in May and a team of Mile-a-Minute "pullers" in June, scenes such as this one where the trees are engulfed in Mile-a-Minute vines are no more on Hankey Mountain. (Lynn Cameron photos)

This was a tremendous team effort involving PATC, Virginia Native Plant Society - Shenandoah Chapter, Headwaters Master Naturalists, Blue Ridge PRISM, Friends of Shenandoah Mountain, and the Forest Service. As Margaret Mead said, "Never underestimate the power of a small group of committed people to change the world. In fact, it is the only thing that ever has."

The group will continue to monitor the site and take care of any MM plants that survived.

--Reported by Lynn Cameron, Friends of Shenandoah Mountain

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